

In the specification:

Please insert the following Title and heading before paragraph [0001]:

INTEGRATED CHARGE RING

FIELD OF THE INVENTION

Please replace paragraph [0001] with:

[0001] The invention concerns an atomizer ~~according to the preamble of Claim 1. More specifically, it pertains to high speed rotary atomizers or also possibly air atomizers, which are necessary~~ for electrostatic series coating of workpieces, such as vehicle chassis, using ~~known~~ side and roof machines and painting robots.

Please insert the following heading between paragraphs [0001] and [0002]:

BACKGROUND OF THE INVENTION

Please insert the following heading between paragraphs [0006] and [0007]:

SUMMARY OF INVENTION

Please insert the following heading between paragraphs [0010] and [0011]:

BRIEF DESCRIPTION OF THE DRAWINGS

Please replace paragraph [0011] with:

[0011] ~~The invention will be explained in more detail with the embodiments illustrated in the drawing. Shown are~~ Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following Detailed Description when considered in connection with the accompanying drawings.

Please insert the following heading between paragraphs [0016] and [0017]:

DETAILED DESCRIPTION OF THE INVENTION

Please replace paragraph [0017] with:

[0017] In a known and conventional way, the high-speed rotary atomizer shown schematically in Figure 1 contains in its outer housing body 1 with the illustrated, essentially hollow cylindrical shape a turbine 2 driven with compressed air. The cone plate 4 rotating in front of the front end of the housing body 1 is mounted on the hollow shaft 3 of this turbine 2. The line for the coating material to the cone plate 4 runs through the hollow shaft 3 in a known way in an paint tube construction 5.

Please replace paragraph [0018] with:

[0018] A holder body 6 for a high-voltage supply device is set on the rear end of the housing body 1. This holder body 6 surrounds the housing body 1 with its cylindrical ring part 61 concentrically, and on its end wall 62 running in the radial direction a high-voltage cable holder 63 is set outwards in the axial direction.

Please replace paragraph [0019] with:

[0019] On the side of the housing body 1 facing the cone plate 4, a ring body 8 is seated in the peripheral area of the housing body 1 adjacent to the holder body 6, on whose rear end a projection 81 is formed with holes distributed uniformly around the axis of rotation of the atomizer. This projection 81 extends axially parallel into the holder body 6. The outer surfaces of the ring body 8 and the holder body 6 form a continuous and gap-less transition. The housing body 1, the ring body 8, and the holder body 6 consist of insulating material. In particular, the bodies 1 and 6, but also the ring body 8 can consist of PTFE, which is considerably less likely to become contaminated due to its surface properties.

Please replace paragraph [0020] with:

[0020] Although the cone plate 4 of an atomizer of the illustrated type can be used for direct charging at an advantageous high voltage, it is assumed here that the coating material sprayed in the radial direction from its rotating edge is initially uncharged and is charged by an electric field outside of the atomizer. For this purpose, a collar of needle electrodes 10 surrounding the axis of rotation is embedded in the ring body 8 on a concentric circle at uniform angle intervals. The electrodes 10 for the illustrated example lie at the front end of the atomizer and thus the tips facing the workpiece to be coated are parallel to the axis of rotation. Instead,

~~they~~ the electrodes 10 can also be arranged at an incline against or facing away from the direction of the axis of rotation.

Please replace paragraph [0021] with:

[0021] Advantageously, the electrodes 10 can be embedded so that the ends of their tips are flush without gaps (without recesses) with the end surfaces 82 or other surface of the insulating ring part surrounding the ends, thus here the ring body 8, so that the electrode 10 tips are not contaminated and the possibly necessary cleaning of the surrounding surface areas of the ring body 8 is not hindered. Here, one possibility is to form the ring body 8 or its surface 82 in the region of the electrode 10 tips, e.g., made of ceramic or some other material, with similarly high strength properties and to form a nonpositive fit with the tightly inserted electrodes 10, which is possible without a significant negative effect on the electrostatic field that can be generated at the ~~needle~~ electrode 10 tips. Another possibility is the arrangement of the ~~needle~~ electrode 10 tips in hollows of the surrounding insulating surface 82, which can be cast with a mass that does not weaken the electrostatic field or optionally can also be covered with a thin protective film.

Please replace paragraph [0023] with:

[0023] The uniform distribution of a larger number of charging electrodes 10 each with corresponding charging resistors 16 increases, among other things, the process reliability if during operation the electrode 10 arrangement approaches impermissibly close to the grounded workpiece, which could lead to arcing or short circuits. This situation is prevented in a known way by electronic control and regulation circuits of the high-voltage generator. Instead of each electrode 10 being assigned to a separate charging resistor 16, however, it is also possible to connect two or more electrodes 10 via a common charging resistor 16 to the high-voltage supply device of the atomizer.

Please replace paragraph [0024] with:

[0024] The high-voltage generator typically consisting of a compact cascade construction must not be connected via an external cable, such as 17, to the electrode 10 arrangement, but instead can also be built into or onto the atomizer directly. It is also possible to provide for each electrode 10 or for individual electrode 10 groups a separate high-voltage generator, e.g., in recesses close to the electrodes 10 similar to the hole of the projection 81.

Please replace paragraph [0025] with:

[0025] It can be seen that the radial distance of the tips of the needle electrodes 10 from the axis of rotation of the atomizer and thus from the spray edge 4' of the cone plate 4 is significantly smaller than for currently typical comparable atomizers. The radial distance of the electrode 10 tips from the spraying edge 4' is for the shown example smaller than its diameter, in contrast, e.g., to EP 0171042 and 0238031, where it should be greater than twice the edge diameter. For air atomizers working with external charging, a corresponding situation applies with the stipulation that the radial distance of the charging electrodes 10 distributed around the longitudinal axis of the atomizer, i.e., the center axis of the paint nozzle, from the electrically conductive parts on the periphery of the spray head should be correspondingly small. Furthermore, it is essential that the electrode 10 tips be set back in the axial direction at such a distance behind the spray edge 4' of the cone plate 4 (or behind the electrically conductive parts of the spray head, e.g., an air atomizer) that the required air isolation path between the possibly grounded spray head and the electrode 10 arrangement is maintained and the ion current flowing between them through the charged air remains limited to permissible values. In reference to the control and regulation measures required for process security, reliable grounding of the relevant components of the atomizer can be important, wherein these components, such as, among other things, the line supplying the coating material to the spray head and adjacent components, can consist advantageously of poor electrically conductive or nonconductive materials, such as plastic or ceramic.

Please replace paragraph [0027] with:

[0027] Furthermore, a guidance air ring 20 inserted in the front opening of the housing body 1' can be seen in Figure 2 with air nozzles 21 distributed on a collar concentrically around the axis of rotation. The guidance air ring has the known function of bringing the spray jet into the desired form and imparting an axial component in the direction towards the workpieces to be coated to the sprayed coating material. The guidance air can be a reason for worse charging, particularly for known atomizers, because it dries the sprayed paint particles and thus reduces their ability to be charged with increasing distance from the spray edge. According to the invention, it has proven to be advantageous if the paint droplets at the spray edge, thus still in the essentially "wet" state, are led directly into a region of high field-line density due to the

radial proximity of the electrode 10 arrangement, where they can be easily charged by the particularly strongly ionized air at that position.

Please replace paragraph [0028] with:

[0028] It can be advantageous to impart an additional motion component in the direction towards the spray head and thus towards the paint particles sprayed there to the ion stream of the air molecules ionized by the electrode 10 tips through another collar of nozzle-like (not shown) air holes concentric to the axis of rotation, which are located in the ring part containing the electrode 10 tips, such as the ring body 8, preferably directly at the electrode 10 tips or in their proximity. This air advantageously guided like a jacket over the surface of the outer housing 1, in Figure 1 the outer housing body 1, simultaneously prevents contamination of the outer housing 1 in this region and is also used as an additional guidance device for stray paint particles in the axial direction towards the workpiece. Instead of a collar of air holes, a circular annular, nozzle-like air gap can also be provided.

Please replace paragraph [0029] with:

[0029] Instead of air, the described nozzle arrangements can also be supplied with another suitable guide gas. In addition, it can be meaningful, for increasing the electrical conductivity of the air molecules in the area of the electrode 10 tips, to blow gas, e.g., air with increased moisture or a gas that increases the conductivity, from the described nozzle arrangement and/or to add a gas that increases the conductivity to the discharged air. The use of gases that increase the corona effect is also conceivable.

Please replace paragraph [0030] with:

[0030] A conductive paint particle layer on the outer side of the atomizer housing could form conductive bridges between the electrodes 10 and grounded parts of the atomizer. Similar to an air or gas jacket around the atomizer housing 1, contamination of the housing 1 can also be prevented by surrounding the housing 1 and preferably the entire outer surface of the atomizer with a jacket of a porous air-permeable material (cf. also EP 0283918 mentioned in the introduction). Another possible means against contamination or self-coating of the outside of the atomizer is to produce the surfaces of the housing 1 and/or other delicate outer parts from a material, which has the property of especially low wettability and/or affects the static electrical charge in the sense of low contamination risk. In addition to other materials or coatings known

from interface chemistry, particularly for water-soluble paint, e.g., materials with the known "lotus effect," correspondingly microstructured surfaces have proven to be suitable (which can also be realized with PTFE).

Please replace paragraph [0031] with:

[0031] Instead of the needle electrodes 10 of the embodiments described here, it is also conceivable to use in the relevant insulating ring part a circular electrode ring concentric to the atomizer axis with a sharply delimited knife edge.

Please replace paragraph [0032] with:

[0032] Figure 3 shows an embodiment modified from Figure 2, for which the outer housing 30 extends with an end ring 31, which is formed, e.g., as one piece with the housing 30 and which projects in the axial direction at its front end like a shield over a rear part of the spray head, here the cone plate 34. The cone plate 34, which, as conventionally, can consist of metal or some other electrically conductive material, is shielded by the end ring 31, so that it does not directly face the electrode tips 103 and a region of greatest field-line density. The end ring 31 thus lies in the direct (straight line) connection path between the cone plate 34 and the electrode tips 103. Through these means, it is possible to arrange the electrode tips 103 in the axial direction closer to the cone plate 34 or spray head. In addition, Figure 3 shows that an even greater number of electrode tips 103 is possible than in Figure 2.

Please replace paragraph [0033] with:

[0033] In a refinement of the invention and the embodiment from Figure 3, according to Figure 4, the periphery of outer housing 40 of the atomizer contains elongated recesses 42 in the axial direction with the illustrated trough-like shape, in which at its rear end the tip of one of the needle electrodes 104 distributed around the axis of rotation is exposed. The trough shape of the recesses 42 should be as easy to clean as possible. The electrodes 104 sunk with its tips in these recesses 42 can be embedded in a separate ring body, e.g., as in Figure 1 or instead also directly in the outer housing 40 itself. The ring body or the outer housing 40 forms end surface areas 84, which surround the electrode 104 tips in the radial direction, thus facing the workpieces to be coated, and which border the trough-shaped recesses 42 at their end. Similar to Figure 3, here the cone plate 44 itself is also shielded (in contrast to the sprayed paint particles) by an end ring 41 extending in the axial direction against too high a field-line concentration.

Please replace paragraph [0035] with:

[0035] Furthermore, in a refinement to the invention, for the embodiment shown in Figure 5, in addition to the electrodes 10', a second arrangement similar to this one of needle electrodes 105 distributed concentrically at equal mutual angular intervals around the axis of rotation is provided. The needle electrodes 105 and/or the electrodes 10' can lie axially parallel according to the illustration or they can form an advantageous angle with the longitudinal direction. The needle electrodes 105 can likewise be embedded like the electrodes 10' according to the illustration in a ring part 8" forming the peripheral wall of the housing body 1' itself or instead in a separate ring body set on the housing body 1'. The ionization ends of this additional electrode 105 arrangement preferably lie in a radial plane, which lies in the axial direction against the ends of the electrodes 10' offset between these and the cone plate 54, and as illustrated their radial distance from the axis of rotation can be smaller than that of the ionization ends of the rear electrodes 10'. The electrodes 105 are connected, similarly to the electrodes 10', via charging resistors 56 to a ring conductor 57, which is located in the ring part 8" concentric to the axis of rotation and which on its side is connected to a high-voltage device in a way that is not shown.

Please replace paragraph [0036] with:

[0036] With the two electrode 10', 105 arrangements separated from each other in the described way, an improved regulation behavior can be achieved, because the operating current (for a large part flowing into the grounded cone plate) is better distributed. In addition, in principle, similarly to the known combined internal and external charging (DE 4105116), the charging is improved, but preferably with a grounded cone plate, wherein the front electrode ring with the needle electrodes 105 is used primarily for charging the coating material and the rear and external electrode ring is also used for guidance and shielding of the spray jet. Preferably, the two (or more) separate electrode 10', 105 arrangements of the described type are each connected to a separate high-voltage generator and set to different potentials, wherein the electrodes 10', 105 lying closer to the spray head, as a rule, are at a lower potential. However, it is also possible to connect the two electrode 10', 105 arrangements to a common high-voltage generator.

Please add the following new paragraphs after paragraph [0036]:

[0036a] The invention has been described in an illustrative manner, and it is to be understood that the terminology which has been used is intended to be in the nature of words of description rather than limitation.

[0036b] Obviously, many modifications and variations of the present invention are possible in light of the above teachings it is, therefore, to be understood that within the scope of the appended claims, wherein reference numerals are merely for convenience and not to be in any way limiting, the invention may be practiced otherwise than as specifically described.